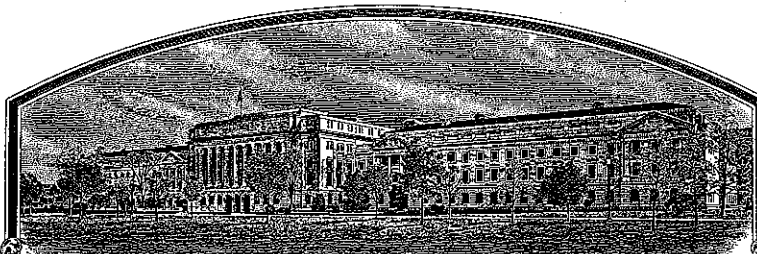


No.

200500265



THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Virginia Tech Intellectual Properties, Inc.

Whereas, THERE HAS BEEN PRESENTED TO THE

Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED DISTINCT VARIETY OF SEXUALLY REPRODUCED, OR TUBER PROPAGATED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF TWENTY YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR IMPORTING IT, OR EXPORTING IT, OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE PURPOSE, OR CONDITIONING IT FOR PROPAGATION, OR STOCKING IT FOR ANY OF THE ABOVE PURPOSE, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT. IN THE UNITED STATES SEED OF THIS VARIETY (1) SHALL BE SOLD BY VARIETY NAME ONLY AS A CLASS OF CERTIFIED SEED AND (2) SHALL CONFORM TO THE NUMBER OF GENERATIONS SPECIFIED BY THE OWNER OF THE RIGHTS. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

BARLEY

'Thoroughbred'

In Testimony Whereof, I have hereunto set my hand and caused the seal of the Plant Variety Protection Office to be affixed at the City of Washington, D.C. this fourteenth day of February, in the year two thousand and six.

Attest:

Commissioner

Plant Variety Protection Office
Agricultural Marketing Service

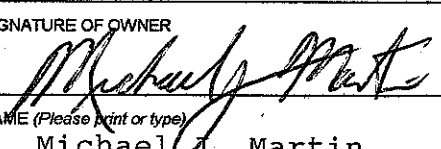


U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
SCIENCE AND TECHNOLOGY - PLANT VARIETY PROTECTION OFFICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE
(Instructions and information collection burden statement on reverse)

The following statements are made in accordance with the Privacy Act of 1974 (5 U.S.C. 552a) and the Paperwork Reduction Act (PRA) of 1995.

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2428).

1. NAME OF OWNER Virginia Tech Intellectual Properties, Inc.		2. TEMPORARY DESIGNATION OR EXPERIMENTAL NAME VA97B-388	3. VARIETY NAME Thoroughbred
4. ADDRESS (Street and No., or R.F.D. No., City, State, and ZIP Code, and Country) Virginia Tech Intellectual Properties, Inc. 1872 Pratt Dr., Suite 1625 Blacksburg, VA 24060		5. TELEPHONE (include area code) 540-951-9378	FOR OFFICIAL USE ONLY PVPO NUMBER <div style="font-size: 2em; font-weight: bold;">200500265</div> FILING DATE <div style="font-size: 1.5em; font-weight: bold;">MAY 26, 2005</div>
		6. FAX (include area code) 540-951-5292	
7. IF THE OWNER NAMED IS NOT A "PERSON", GIVE FORM OF ORGANIZATION (corporation, partnership, association, etc.) Corporation	8. IF INCORPORATED, GIVE STATE OF INCORPORATION Virginia	9. DATE OF INCORPORATION June 20, 1985	
10. NAME AND ADDRESS OF OWNER REPRESENTATIVE (S) TO SERVE IN THIS APPLICATION. (First person listed will receive all papers) Carl A. Griffey Crop and Soil Environmental Sciences Virginia Tech Blacksburg, VA 24061-0404			FEES RECEIVED
			FILING AND EXAMINATION FEES: \$ 3,652.00 DATE 05/26/05 CERTIFICATION FEE: \$ 768.00 DATE 1/30/2006
11. TELEPHONE (include area code) 540-231-9789	12. FAX (include area code) 540-231-3431	13. E-MAIL Cgriffey@vt.edu	14. CROP KIND (Common Name) Barley
18. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED (Follow instructions on reverse) a. <input checked="" type="checkbox"/> X Exhibit A. Origin and Breeding History of the Variety b. <input checked="" type="checkbox"/> X Exhibit B. Statement of Distinctness c. <input checked="" type="checkbox"/> X Exhibit C. Objective Description of Variety d. <input checked="" type="checkbox"/> X Exhibit D. Additional Description of the Variety (Optional) e. <input checked="" type="checkbox"/> X Exhibit E. Statement of the Basis of the Owner's Ownership f. <input checked="" type="checkbox"/> X Voucher Sample (2,500 viable untreated seeds or, for tuber propagated varieties, verification that tissue culture will be deposited and maintained in an approved public repository) g. <input checked="" type="checkbox"/> X Filing and Examination Fee (\$3,652), made payable to "Treasurer of the United States" (Mail to the Plant Variety Protection Office)		19. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE SOLD AS A CLASS OF CERTIFIED SEED? See Section 83(a) of the Plant Variety Protection Act <input checked="" type="checkbox"/> X YES (If "Yes", answer items 20 and 21 below) <input type="checkbox"/> NO (If "no," go to item 22)	
22. HAS THE VARIETY (INCLUDING ANY HARVESTED MATERIAL) OR A HYBRID PRODUCED FROM THIS VARIETY BEEN SOLD, DISPOSED OF, TRANSFERRED, OR USED IN THE U. S. OR OTHER COUNTRIES? <input checked="" type="checkbox"/> X YES <input type="checkbox"/> NO IF YES, YOU MUST PROVIDE THE DATE OF FIRST SALE, DISPOSITION, TRANSFER, OR USE FOR EACH COUNTRY AND THE CIRCUMSTANCES. (Please use space indicated on reverse.)		20. DOES THE OWNER SPECIFY THAT SEED OF THIS VARIETY BE LIMITED AS TO NUMBER OF CLASSES? <input checked="" type="checkbox"/> X YES <input type="checkbox"/> NO IF YES, WHICH CLASSES? <input checked="" type="checkbox"/> X FOUNDATION <input checked="" type="checkbox"/> X REGISTERED <input type="checkbox"/> X CERTIFIED	
		21. DOES THE OWNER SPECIFY THAT THE CLASSES BE LIMITED AS TO NUMBER OF GENERATIONS? <input type="checkbox"/> YES <input checked="" type="checkbox"/> NO IF YES, SPECIFY THE NUMBER 1, 2, 3, etc. <input type="checkbox"/> FOUNDATION <input type="checkbox"/> REGISTERED <input type="checkbox"/> CERTIFIED (If additional explanation is necessary, please use the space indicated on the reverse.)	
23. IS THE VARIETY OR ANY COMPONENT OF THE VARIETY PROTECTED BY INTELLECTUAL PROPERTY RIGHT (PLANT BREEDER'S RIGHT OR PATENT)? <input checked="" type="checkbox"/> YES <input type="checkbox"/> X NO IF YES, GIVE COUNTRY, DATE OF FILING OR ISSUANCE AND ASSIGNED REFERENCE NUMBER. (Please use space indicated on reverse.)			
24. The owners declare that a viable sample of basic seed of the variety will be furnished with application and will be replenished upon request in accordance with such regulations as may be applicable, or for a tuber propagated variety a tissue culture will be deposited in a public repository and maintained for the duration of the certificate. The undersigned owner(s) is(are) the owner of this sexually reproduced or tuber propagated plant variety, and believe(s) that the variety is new, distinct, uniform, and stable as required in Section 42, and is entitled to protection under the provisions of Section 42 of the Plant Variety Protection Act. Owner(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.			
SIGNATURE OF OWNER  NAME (Please print or type) Michael J. Martin		SIGNATURE OF OWNER NAME (Please print or type)	
CAPACITY OR TITLE Executive Vice President	DATE 5/25/05	CAPACITY OR TITLE 	DATE

GENERAL: To be effectively filed with the Plant Variety Protection Office (PVPO), **ALL** of the following items must be received in the PVPO: (1) Completed application form signed by the owner; (2) completed exhibits A, B, C, E; (3) for a seed reproduced variety at least 2,500 viable untreated seeds, for a hybrid variety at least 2,500 untreated seeds of each line necessary to reproduce the variety, or for tuber reproduced varieties verification that a viable (*in the sense that it will reproduce an entire plant*) tissue culture will be deposited and maintained in an approved public repository; (4) check drawn on a U.S. bank for \$2,450 (\$300 filing fee and \$2,150 examination fee), payable to "Treasurer of the United States" (See Section 97.6 of the Regulations and Rules of Practice.) Partial applications will be held in the PVPO for not more than 90 days, then returned to the applicant as unfilled. Mail application and other requirements to Plant Variety Protection Office, AMS, USDA, Room 500, NAL Building, 10301 Baltimore Avenue, Beltsville, MD 20705-2351. Retain one copy for your files. All items on the face of the application are self explanatory unless noted below. Corrections on the application form and exhibits must be initialed and dated. **DO NOT** use masking materials to make corrections. If a certificate is allowed, you will be requested to send a check payable to "Treasurer of the United States" in the amount of \$300 for issuance of the certificate. Certificates will be issued to owner, not licensee or agent.

Plant Variety Protection Office

Telephone: (301) 504-5518

FAX: (301) 504-5291

Homepage: <http://www.ams.usda.gov/science/pvp.htm>

ITEM

- 18a. Give: (1) the genealogy, including public and commercial varieties, lines, or clones used, and the breeding method;
(2) the details of subsequent stages of selection and multiplication;
(3) evidence of uniformity and stability; and
(4) the type and frequency of variants during reproduction and multiplication and state how these variants may be identified
- 18b. Give a summary of the variety's distinctness. Clearly state how this application variety may be distinguished from all other varieties in the same crop. If the new variety is most similar to one variety or a group of related varieties:
(1) identify these varieties and state all differences objectively;
(2) attach statistical data for characters expressed numerically and demonstrate that these are clear differences; and
(3) submit, if helpful, seed and plant specimens or photographs (prints) of seed and plant comparisons which clearly indicate distinctness.
- 18c. Exhibit C forms are available from the PVPO Office for most crops; specify crop kind. Fill in Exhibit C (Objective Description of Variety) form as completely as possible to describe your variety.
- 18d. Optional additional characteristics and/or photographs. Describe any additional characteristics that cannot be accurately conveyed in Exhibit C. Use comparative varieties as is necessary to reveal more accurately the characteristics that are difficult to describe, such as plant habit, plant color, disease resistance, etc.
- 18e. Section 52(5) of the Act requires applicants to furnish a statement of the basis of the applicant's ownership. An Exhibit E form is available from the PVPO.
19. If "Yes" is specified (*seed of this variety be sold by variety name only, as a class of certified seed*), the applicant **MAY NOT** reverse this affirmative decision after the variety has been sold and so labeled, the decision published, or the certificate issued. However, if "No" has been specified, the applicant may change the choice. (*See Regulations and Rules of Practice, Section 97.103.*)
21. See Section 83 of the Act for the Contents and Term of Plant Variety Protection.
22. See Sections 41, 42, and 43 of the Act and Section 97.5 of the regulations for eligibility requirements.
23. See Section 5.5 of the Act for instructions on claiming the benefit of an earlier filing date.

21. CONTINUED FROM FRONT (*Please provide a statement as to the limitation and sequence of generations that may be certified.*)

22. CONTINUED FROM FRONT (*Please provide the date of first sale, disposition, transfer, or use for each country and the circumstances, if the variety (including any harvested material) or a hybrid produced from this variety has been sold, disposed of, transferred, or used in the U.S. or other countries.*)

A limited amount of Certified seed of Thoroughbred was sold in the U.S. A. for the first time in October 2004.

23. CONTINUED FROM FRONT (*Please give the country, date of filing or issuance, and assigned reference number, if the variety or any component of the variety is protected by intellectual property right (Plant Breeder's Right or Patent).*)

NOTES: It is the responsibility of the applicant/owner to keep the PVPO informed of any changes of address or change of ownership or assignment or owner's representative during the life of the application/certificate. There is no charge for filing a change of address. The fee for filing a change of ownership or assignment or any modification of owner's name is specified in Section 97.175 of the regulations. (*See Section 101 of the Act, and Sections 97.130, 97.131, 97.175(h) of the Regulations and Rules of Practice.*)

To avoid conflict with other variety names in use, the applicant must check the variety names proposed by contacting: Seed Branch, AMS, USDA, Room 213, Building 306, Beltsville Agricultural Research Center—East, Beltsville, MD 20705. Telephone: (301) 504-8089.

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number for this collection of information is (0581-0055). The time required to complete this information collection is estimated to average 1.4 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, political beliefs, sexual orientation, and marital or family status. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact the USDA's TARGET Center at 202-720-2600 (voice and TDD). To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, DC 20250-9410 or call (202) 720-5964

18A. Exhibit A: Origin and Breeding History**Genealogy and Breeding Method.**

THOROUGHbred winter feed barley was derived from cross VA90-44-110/'Plaisant'. The parentage of VA90-44-110 is CIho8618/'Surry'/'Sussex'/3/'Henry', 'Maury', VA79-44-167. CIho8618 (PI178381) is an awned winter barley accession from Turkey that was used as a source of resistance to scald (*Rhynchosporium secalis*). The parentage of VA79-44-167 is 'Cebada Capa'/'Wong'/'Awnleted 'Hudson'/3/'Harrison'/4/Harrison/3/Cebada Capa/Wong/'Awnleted Hudson. Plaisant (PI584894) is an awned French winter malting variety. The cross was made in spring 1991, and the F₁ generation was grown in the field at Warsaw, VA as a single 4ft headrow in 1992 to produce F₂ seed. The population was advanced from the F₂ to F₄ generation using a modified bulk breeding method.

Population Advancement and Selection of the Variety.

Barley spikes were selected from the population in each segregating generation (F₂-F₄) on the basis of absence of obvious disease, early maturity, short straw and desirable head type and size. Selected spikes were threshed in bulk, and the seed was planted in 225ft² blocks at Blacksburg and Warsaw, VA in the fall of each year. Spikes selected from the F₄ bulk were threshed individually and planted in separate 4ft headrows. THOROUGHbred barley was derived as a bulk of one of these F_{4.5} headrows selected in 1996.

THOROUGHbred was tested as entry 388 in non-replicated observation yields tests at Blacksburg and Warsaw, VA in 1997 and was previously designated VA97B-388.

THOROUGHbred was tested as VA97B-388 in Official Variety Trials in Virginia from 1999 to 2002 (Tables 1-5), and in those of other southern and mid-Atlantic states in 2001 (Table 12) and 2002 (Table 13). It also was tested for two years (1999-2001) in the USDA-ARS Uniform Winter Barley Yield Nursery (Tables 6-9) and in the USDA-ARS Uniform Barley Winter Hardiness Nursery (Tables 10 and 11).

Multiplication and Purification.

An initial source of THOROUGHbred Breeder seed was developed in 2002 via thorough removal of visual variant plants from a 0.3-acre F₁₁ increase strip sown at the VCIA Foundation Seed Farm. This increase strip produced about 30 bushels of Breeder seed that was planted during the fall of 2002 on 10 acres at the Foundation Seed Farm. This seed increase block produce about 1,000 bushels of THOROUGHbred Foundation seed that was available for distribution to seedsmen in fall 2003. A purer source of THOROUGHbred Breeder seed was subsequently developed. During 2002-2003 crop season, 400 headrows of THOROUGHbred, each originating from a single spike, were planted and evaluated for homogeneity and trueness of type. Variant headrows were removed prior to harvest, and the remaining 396 F₁₂ rows were harvested in bulk to form a purer source of Breeder seed, which was provided to VCIA Foundation Seed Farm during fall 2003. This Breeder seed was planted on 1.5 acres and produced about 100 bu of Foundation seed, which will be used as stock seed for subsequent increases.

While THOROUGHbred has remained stable and uniform in composition through the past three generations of self pollination, variants observed within the variety include up to 0.5% plants having lax spikes, 0.5% plants having awnless spikes or spikes with short awns, and 0.1% plants 4 to 6 inches taller in height.

18B. Exhibit B: Novelty Statement

THOROUGHNBRED is uniquely different from all known barley cultivars, but is most similar to the cultivar Price. The stem peduncle or neck of THOROUGHNBRED is slightly curved, while that of Price is erect. Spikes of THOROUGHNBRED are erect but not dense, have long lemma awns that are longer than the spike in length, and lateral kernels do not overlap. In contrast, spikes of Price are erect and dense, have short lemma awns that are less than equal to the spike in length, and lateral kernels of one third to one half of the spike overlap. Glume awns of THOROUGHNBRED are smooth while those of Price are rough. Seedlings of THOROUGHNBRED are susceptible (Infection type = 4 on 0=Resistant to 4=Susceptible scale) to leaf rust (*Puccinia hordei*) races 8 and 30, while those of Price are resistant (IT = 0;) to race 8 (virulence for genes *Rph1*, 4, 8, 10, and 11) and moderately susceptible (IT = 2+) to race 30 (virulence for genes *Rph1*, 2, 4, 6, 7, 8, and 11). THOROUGHNBRED has consistently been more susceptible to leaf rust in field tests than Price as noted in the table below. Ratings based on disease severity where 0=Resistant, lacking sporulating pustules to 9=Susceptible with sporulating pustules nearly covering leaves.

	1999 Lr (0-9)	2000 Lr (0-9)	2001 Lr (0-9)	2002 Lr (0-9)
Thoroughbred	9	8	6	6
Price	5	5	4	4
L.S.D.	1.0	1.0	1.0	1.0
N=No. of tests	1	2	1	2

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
LIVESTOCK AND SEED DIVISION
BELTSVILLE, MARYLAND 20705

EXHIBIT C
(Barley)

OBJECTIVE DESCRIPTION OF VARIETY
BARLEY (*HORDEUM VULGARE*)

INSTRUCTIONS: See Reverse.

NAME OF APPLICANT(S)

Virginia Tech Intellectual Properties, Inc.

ADDRESS (Street and No. or R.F.D. No., City, State, and ZIP Code)

1872 Pratt Dr., Ste. 1625

Blacksburg, VA 24060

FOR OFFICIAL USE ONLY

PVPO NUMBER

200500265

VARIETY NAME OR TEMPORARY
DESIGNATION

Thoroughbred/(VA97B-388)

Place the appropriate number that describes the varietal character of this variety in the boxes below.

Place a zero in first box (i.e., or) when number is either 99 or less or 9 or less.

1. GROWTH HABIT:

1 - SPRING 2 - FACULTATIVE WINTER 3 - WINTER Early Growth: 1 - PROSTRATE 2 - SEMIPROSTRATE
3 - ERECT

2. MATURITY (50% Flowering):

1 - EARLY (California Mariout) 2 - MIDSEASON (Betzes) 3 - LATE (Frontier)

No. of days Earlier than } 1 - BETZES 2 - CALIFORNIA MARIOUT 3 - CONQUEST 4 - DICKSON

No. of days Later than } 5 - PIROLINE 6 - PRIMUS 7 - UNITAN 8 - Perkins 9 - Nomini

3. PLANT HEIGHT (From soil level to top of head):

1 - SEMIDWARF 2 - SHORT (California Mariout) 3 - MEDIUM TALL (Betzes) 4 - TALL (Conquest)

Cm. Shorter than } 1 - BETZES 2 - CALIFORNIA MARIOUT 3 - CONQUEST 4 - DICKSON

Cm. Taller than } 5 - PIROLINE 6 - PRIMUS 7 - UNITAN 8 - Callao 9 - Nomini

4. STEM:

Exertion (Flag to spike at maturity): 1 - 0 - 3 cm. 2 - 3 - 10 cm. Anthocyanin: 1 - ABSENT 2 - PRESENT
3 - 10 - 15 cm.

NO. OF NODES (Originating from node above ground)

Collar Shape: 1 - CLOSED 2 - V-SHAPED 3 - OPEN Shape of Neck: 1 - STRAIGHT 2 - SNAKY
4 - MODIFIED CLOSED OR OPEN 3 - OTHER (Specify) Slightly curved

5. LEAF:

Basal leaf sheath (seedling): 1 - GLABROUS 2 - PUBESCENT Position of flag leaf (at boot stage): 1 - DROOPING
2 - UPRIGHT

Waxiness: 1 - ABSENT (Glossy) 2 - SLIGHTLY WAXY MM. WIDTH (First leaf below flag leaf)

CM. LENGTH (First leaf below flag leaf) Anthocyanin in leaf sheath: 1 - ABSENT 2 - PRESENT

6. HEAD:

Type: 1 - TWO-ROWED 2 - SIX-ROWED Density: 1 - LAX 2 - ERECT (Not dense)
3 - ERECT (Dense)

Shape: 1 - TAPERING 2 - STRAP 3 - CLAVATE Waxiness: 1 - ABSENT (Glossy) 2 - SLIGHTLY WAXY
4 - OTHER (Specify) Strap & Parallel 3 - WAXY

Lateral Kernels Overlap: 1 - NONE 2 - AT TIP Rachis (Hair on edge): 1 - LACKING 2 - FEW 3 - COVERED
3 - 1/4 - 1/2 OF HEAD

7. GLUME:

Length: 1 - 1/3 OF LEMMA 2 - 1/2 OF LEMMA Hairs: 1 - NONE 2 - SHORT 3 - LONG
3 - MORE THAN 1/2 OF LEMMA

Hair covering: 1 - NONE 2 - RESTRICTED TO MIDDLE 3 - CONFINED TO BAND 4 - COMPLETELY COVERED

Awns: 1 - LESS THAN EQUAL TO LENGTH OF GLUMES 2 - EQUAL TO LENGTH OF GLUMES
3 - MORE THAN EQUAL TO LENGTH OF GLUMES

Awn Surface: 1 - SMOOTH 2 - SEMISMOOTH 3 - ROUGH

5

8. LEMMA:

- ☐ 5 Awn: 1 - AWNLESS 2 - AWNLETS ON CENTRAL ROWS AWNLESS ON LATERAL ROWS
 3 - SHORT ON CENTRAL ROWS, AWNLETS ON LATERAL ROWS 4 - SHORT (less than equal to length of spike)
 5 - LONG (longer than spike) 6 - HOODED
- ☐ 4 Awn Surface: 1 - AWNLESS 2 - SMOOTH 3 - SEMISMOOTH 4 - ROUGH
- ☐ 2 Teeth: 1 - ABSENT 2 - FEW 3 - NUMEROUS ☐ 1 Hair: 1 - ABSENT 2 - PRESENT
- ☐ 1 Shape of base: 1 - DEPRESSION 2 - SLIGHT CREASE ☐ 2 Rachilla Hairs: 1 - SHORT 2 - LONG
 3 - TRANSVERSE CREASE

9. STIGMA:

- ☐ Hairs: 1 - FEW 2 - MANY

10. SEED:

- ☐ 2 Type: 1 - NAKED 2 - COVERED ☐ 1 Hairs on Ventral Furrow: 1 - ABSENT 2 - PRESENT
- ☐ 4 Length: 1 - SHORT (8.0 mm.) 2 - SHORT TO MIDLONG (7.5 - 9.0 mm.) 3 - MIDLONG (8.5 - 9.5 mm.)
 4 - MIDLONG TO LONG (9.0 - 10.5 mm.) 5 - LONG (10.0 mm.)
- ☐ 2 Wrinkling of hull: 1 - NAKED 2 - SLIGHTLY WRINKLED 3 - SEMIWRINKLED 4 - WRINKLED
- ☐ 1 Aleurone Color: 1 - COLORLESS (White or Yellow) 2 - BLUE
- ☐ PERCENT ABORTIVE ☐ 3 ☐ 4 GMS. PER 1000 SEEDS

11. DISEASE: (0 = Not Tested, 1 = Susceptible, 2 = Resistant) 3 = Intermediate

- ☐ 0 SEPTORIA ☐ 3 NET BLOTCH ☐ 0 SPOT BLOTCH ☐ 2 POWDERY MILDEW
- ☐ 0 LOOSE SMUT ☐ 0 BACTERIAL BLIGHT ☐ 0 COVERED SMUT ☐ 0 FALSE LOOSE SMUT
- ☐ 0 STEM RUST ☐ 1 LEAF RUST ☐ 1 SCAB ☐ 0 SCALD
- ☐ 0 AY ☐ 0 BSMV ☐ 2 BYDV ☐ OTHER (Specify)

12. INSECT: (0 = Not tested, 1 = Susceptible, 2 = Resistant)

- ☐ 0 GREEN BUG ☐ 0 ENGLISH GRAIN APHID ☐ 0 CHINCH BUG ☐ 0 ARMYWORM
- ☐ 0 GRASS HOPPERS ☐ 0 CERIAL LEAF BETTLE ☐ 0 OTHER (Specify)
- HESSIAN FLY RACES ☐ 0 GP ☐ 0 A ☐ 0 B ☐ 0 C
☐ 0 D ☐ 0 E ☐ 0 F ☐ 0 G

13. CHEMICAL (0 = Not Tested, 1 = Susceptible, 2 = Resistant)

- ☐ 0 DDT ☐ OTHER (Specify)

14. INDICATE WHICH VARIETY MOST CLOSELY RESEMBLES THAT SUBMITTED:

CHARACTER	NAME OF VARIETY	CHARACTER	NAME OF VARIETY
Plant tillering	Callao	Seed size	Callao
Leaf size	Nomini	Coleoptile elongation	
Leaf color	Callao	Seedling pigmentation	Callao
Leaf carriage	Callao		

REFERENCES: The following publications may be used as a reference aid for the standardization of character descriptions and terms used in this form:

1. Wiebe, G. A., and D. A. Reid, 1961, Classification of Barley Varieties Grown in the United States and Canada in 1958, Technical Bulletin No. 1224, U.S. Dept. of Agriculture.
2. Reid, D. A., and G. A. Wiebe, 1968, Barley: Origin, Botany, Culture, Winter Hardiness, Genetics, Utilization, Pests, Agriculture Handbook No. 338, U.S. Dept. of Agriculture. pp. 61 - 84.
3. Malting Barley Improvement Association, Milwaukee, Wisconsin, 1971, Barley Variety Dictionary.

COLOR: Nickerson's or any recognized color fan may be used to determine color of the described variety.

FORM LFGS-470-5 (8-80) (REVERSE)

18D. Exhibit D: Additional Description of Thoroughbred Barley.

THOROUGHbred is a high yielding, full season, awned, six-row hulled winter-feed barley having very good straw strength, high test weight, and bright plump seed. On average, head emergence of THOROUGHbred is 2 days later than 'Wysor', 4 days later than 'Nomini' and 'Price', and 6 days later than 'Callao' (Tables 1-5,7,9). Average plant height of THOROUGHbred (36 inches) is 3-4 inches taller than Callao and Price, and 3-4 inches shorter than Wysor and Nomini. Straw strength (0=no lodging, 10=completely lodged) of THOROUGHbred (1.4) is similar to those of Price (1.5) and Nomini (1.7), and better than those of Wysor (2.8) and Callao (5.0).

Average grain yield (1999-2002) of THOROUGHbred (120 Bu/ac) in Virginia (Table 1) has been excellent in comparison with those of Nomini (118 Bu/ac), Price (116 Bu/ac) and Callao (111 Bu/ac). In three out of four years, grain yields of THOROUGHbred exceeded ($P \leq 0.05$) those of Nomini by 6-14 Bu/ac and those of Callao by 8-18 Bu/ac (Tables 2,3,5). In the Uniform Winter Barley Yield Nursery, average grain yield of THOROUGHbred (114 Bu/ac) over 10 states in 2000 (Table 8) was 10-14 Bu/ac higher than those of Nomini, Price and Callao, and in 2001 over four states (Table 6) average yield of THOROUGHbred (110 Bu/ac) was 8-9 Bu/ac higher than those of Nomini and Callao. Over all locations, THOROUGHbred ranked 1st among 23 entries in 2000 and 3rd among 23 entries in 2001.

Average test weight of THOROUGHbred (51.2 Lb/Bu) in Virginia (Table 1) has been similar to those of Callao (51.5 Lb/Bu) and Price (50.9 Lb/Bu), and significantly ($P \leq 0.05$) higher than those of Wysor (48.9 Lb/Bu) and Nomini (48.3 Lb/Bu). In the Uniform Winter Barley Yield Nursery, average test weight of THOROUGHbred in 2000 (47.0 lb/bu) was similar to that of Price and 0.5 Lb/Bu higher than that of Nomini (Table 9), and in 2001 THOROUGHbred had an average test weight (48 Lb/Bu) that was similar to that of Callao and exceeded ($P \leq 0.05$) that of Nomini by 1.7 Lb/Bu (Table 7).

Winter hardiness of THOROUGHbred is good and significantly ($P \leq 0.05$) better than that of 'Trebi', the winter-tender check (Tables 10 and 11). In the 1999-2000 Uniform Barley Winter Hardiness Nursery, THOROUGHbred ranked 1st among 29 entries with a mean survival score of 93.5%, compared with 81% for 'Tennessee Winter', 85% for 'Kentucky 1', and 63% for Trebi (Tables 11). In 2000-2001 tests, average winter survival of THOROUGHbred (54.5%) was similar to those of Tennessee Winter (50%) and Kentucky 1 (58.6%) and significantly ($P \leq 0.05$) higher than that of Trebi (35%).

THOROUGHbred is resistant to powdery mildew (*Blumeria graminis* f. sp. *hordei*) and barley yellow dwarf virus (Tables 2-5 and 9). It is moderately susceptible to leaf rust (*Puccinia hordei*) and net blotch (*Pyrenophora teres*).

Table 1. Four-year summary of performance of VA97B-388 in the Virginia Tech Barley Test, 1999 - 2002 harvests.*

Line	Yield (Bu/acre) (18)	Test Weight (Lb/bu) (16)	Date Headed (Mar. 31+) (15)	Height (In) (13)	Lodging♥ (0.2-10) (16)
VA97B-388	120.4 +	51.2 +	24 +	36 -	1.4 -
NOMINI	117.7	48.3 -	19 -	41 +	1.5 -
PRICE	116.2	50.9 +	20	34 -	1.5 -
CALLAO	110.7 -	51.5 +	17 -	32 -	5.1 +
WYSOR	108.0 -	48.9 -	22 +	40 +	2.7
Test Average (n=5)	114.6	50.2	20	37	2.4
C.V.	9.2	2.0	6	3	59.9
L.S.D. (0.05)	3.6	0.4	0.5	0.5	0.5

* A plus or minus sign indicates a performance significantly above or below the test average.

The number in parentheses below column headings indicates the number of location-years on which data are based.

♥ Belgian Lodging Scale = Area x Intensity x 0.2. Area = 1-10, where 1 is barley unaffected and 10 is entire plot affected and Intensity = 1-5, where 1 is barley standing upright and 5 is barley totally flat.

Table 2. Summary of performance of VA97B-388 in the Virginia Tech Barley Test, 2002 harvest.*

	Yield	Test	Date	Height	Leaf	Powdery	Net	Spring	Early	Lodging
	(Bu/a)	Weight	Headed	(In)	Rust	Mildew	Blotch	Freeze	Height	(0.2-10)
	(5)	(Lb/bu)	(Mar31+)	(4)	(2)	(0-9)	(1)	(%)	(In)	(3)
VA97B-388	119 +	53.6 +	19 +	35 +	6 +	0	5 -	5	5.8	2.5
NOMINI	113 +	50.0 -	17	40 +	3	0	2 -	3	6.3	3.2
PRICE	109	51.7	16 -	32	4 +	0	6	8	6.0	3.1
WYSOR	101 -	50.2 -	19 +	38 +	6 +	0	6	0	4.8 -	4.1 +
CALLAO	101 -	52.8 +	15 -	30 -	3	0	5 -	15	6.0	4.4 +
Average (n=29)	107	51.7	17	32	3	0	6	9	6.7	3.2
C.V.	8	2.4	6	4	34	420	14	120	12.4	31.4
LSD (0.05)	5	0.8	1	1	1	1	1	15	1.2	0.8

* Varieties are ordered by descending statewide yield averages. A plus or minus sign indicates a performance significantly above or below the test average, where hulled and hulless lines have been statistically analyzed separately.

The number in parentheses below column headings indicates the number of locations on which data are based.

The 0-9 ratings indicate degree to which plant is affected, where 0=none and 9=total plant affected.

Belgian Lodging Scale = Area X Intensity X 0.2. Area = 1-10, where 1 is barley unaffected and 10 is entire plot affected and Intensity = 1-5, where 1 is barley standing upright and 5 is barley totally flat.

Spring freeze damage is the percentage of tillers killed by a low temperature of 21 degrees F. on March 2-3, 2002. Ratings were made on April 29, 2002.

Early height is an indication of the daylength sensitivity of a variety. The association between early growth and freeze injury in barley is much lower than in wheat.

Table 3. Summary of performance of VA97B-388 in the Virginia Tech Barley Test, 2001 harvest.*

Line	Yield (Bu/acre) (5)	Test Weight (Lb/bu) (4)	Date Headed (Mar. 31+) (4)	Height (In) (3)	Lodging▼ (0.2-10) (4)	Leaf	Spring
						Rust (0-9) (1)	Freeze Damage (0-9) (1)
VA97B-388	120 +	50.5 -	28 +	33	1.7 -	6 +	3 -
PRICE	110 +	50.2 -	25 +	31 -	2.1	4 +	4
NOMINI	106	47.7 -	23 -	38 +	1.8 -	4 +	2 -
CALLAO	104	50.1 -	20 -	30 -	7.7 +	3	5 +
WYSOR	98	48.0 -	25 +	37 +	4.6 +	8 +	3 -
Average (n=41)	101	52.2	24	33	3.1	3	4
C.V.	10	1.6	8	3	50.5	23	13
L.S.D. (0.05)	7	0.6	1	1	1.1	1	1

* Varieties are ordered by descending statewide yield averages. A plus or minus sign indicates a performance significantly above or below the test average. The number in parentheses below column headings indicates the number of locations on which data are based. There are four replications at each location, except at Orange which had two replications.

▼ Belgian Lodging Scale = Area x Intensity x 0.2. Area = 1-10, where 1 is barley unaffected and 10 is entire plot affected and Intensity = 1-5, where 1 is barley standing upright and 5 is barley totally flat.

◆ The 0-9 ratings indicate degree to which plant is affected, where 0 = none and 9 = total plant is affected.

Table 4. Summary of performance of VA97B-388 in the Virginia Tech Barley Test, 2000 harvest*.

Brand/Variety	Yield (Bu/A) (4)	Test Weight (Lb) (4)	Date Headed (Mar. 31+) (4)	Height (In) (3)	Lodging** (0.2-10) (5)	Leaf Rust (0-9)◇ (2)	Powdery Mildew (0-9) (2)
VA97B-388	109	50.6	21 +	39 +	1.5	8 +	0
NOMINI	130 +	47.6 -	16 -	43 +	1.0 -	5	0
PRICE	116	51.4 +	17	37	1.0 -	5	0
CALLAO	115	52.0 +	15 -	35 -	4.4 +	5	0
WYSOR	112	48.9 -	20 +	43 +	1.8	7 +	0
Average (n=31)	114	50.6	17	37	1.9	5	1
C.V.	10	1.9	5	3	---	---	---
L.S.D. (0.05)	8	0.7	1	1	0.8	1	1

* Varieties are ordered by descending statewide averages. A plus or minus sign indicates a performance significantly above or below the test average. The number in parentheses below column headings indicates the number of locations on which data are based. There are four replications at each location.

** Belgian Lodging Scale = Area X Intensity X 0.2. Area = 1-10, where 1 is barley unaffected and 10 is entire plot affected and Intensity=1-5, where 1 is barley standing upright and 5 is barley lying totally flat.

◇The 0-9 ratings indicate relative disease intensity where 0=none and 9=total plant infection.

Table 5. Summary of performance of VA97B-388 in the Virginia Tech Barley Test, 1999 harvest.*

Brand/Variety	Yield (Bu/A) (4)	Test Weight (Lb) (4)	Date Headed (Mar. 31+) (3)	Height (In) (3)	Lodging** (0.2-10) (4)	Powdery Mildew (0-9) (1)	Leaf Rust (0-9) (1)
VA97B-388	133 +	50.1	27 +	38 +	0.2 -	2 +	9 +
PRICE	133 +	50.3	22 +	37	0.3 -	1	5
WYSOR	128	48.8 -	24 +	42 +	0.9	1	9 +
NOMINI	127	47.6 -	21 +	43 +	0.6	1	7 +
CALLAO	125	51.2 +	19 -	35 -	4.0 +	1	6 +
Test Average (n=26)	127	50.1	20	37	0.9	1	5
LSD (0.05)	6	0.5	1	1	0.6	1	1

* Varieties are ordered by descending statewide averages. A plus or minus sign indicates a performance significantly above or below the test average. The number in parentheses below column headings indicates the number of locations on which data are based. There are four replications at each location.

** Belgian Lodging Scale = Area X Intensity X 0.2. Area = 1-10, where 1 is barley unaffected and 10 is entire plot affected and Intensity=1-5, where 1 is barley standing upright and 5 is barley lying totally flat.

◇The 0-9 ratings indicate relative disease intensity where 0=none and 9=total plant infection.

Table 6. Ranked yield averages of VA97B-388 versus check varieties over all stations in the 2000-2001 Uniform Winter Barley Yield Nursery.

Selection or Variety	Yield (bu/A)	Yield Rank	MD ¹ Queenstown	SC Clemson	SC Florence	TX Prosper	VA Blacksburg	VA Warsaw
VA97B-388	110.3	3	129.3	120.0	110.0	33.3	116.0	153.2
Callao	101.2	11	119.7	92.4	109.0	32.9	110.3	142.9
Wysor	95.3	16	106.0	97.2	94.1	42.7	91.7	140.3
Nomini	102.6	9	118.5	108.0	91.3	63.5	98.3	136.1
Perkins	78.5	23	91.7	65.8	76.1	18.7	96.0	122.9
VA97B-176	107.4	5	124.8	118.0	112.0	30.3	111.0	148.4
<i>Average (N=24)</i>	96.8		114.2	93.7	94.7	38.1	102.7	137.3
<i>LSD (0.10)</i>	11.49 ²		17.9	12.7	11.6	11.2	10.1	7.8
<i>C.V. (%)</i>	10.4		9.1	9.9	8.9	27.3	9.3	5.4

¹ Results of 2 reps.

² LSD (0.05)

Table 7. Performance of VA97B-388 versus check varieties in the 2000-2001 Uniform Winter Barley Nursery: Averages over all stations for indicated characters.

Selection or Variety	Yield Rank	Yield (bu/A)	Test Weight (lbs/bu)	Heading Date (Julian)	Height (in.)	Lodging (0-9) ¹	Winter Kill (0-9)
VA97B-388	3	110.3	48.0	112	34.4	2.3	6.9
Callao	11	101.2	48.1	107	32.5	5.7	6.9
Wysor	16	95.3	45.6	111	37.8	4.2	6.8
Nomini	9	102.6	46.3	108	38.9	3.3	6.7
Perkins	23	78.5	47.6	117	35.1	5.3	1.8
VA97B-176	5	107.4	49.5	108	32.6	3.5	7.1
<i>Average (N=24)</i>		96.8	46.8	111	35.2	4.0	6.3
<i>LSD (0.05)</i>		11.5	1.7	2.0	1.7	2.6	2.8
<i>C.V. (%)</i>		10.4	3.2	1.6	4.6	38.5	27.7
<i>No. Locations</i>		6	6	6	7	3	3

¹ All 0-9 ratings indicate relative disease/lodging/winter kill severity: 0 = no disease/lodging/winter kill present; 9 = total infestation of the plant by disease/completely lodged/100% winter kill.

Table 8. Ranked yield averages of VA97B-388 versus check varieties over all stations in the 1999-2000 Uniform Winter Barley Yield Nursery.

Selection or Variety	Yield Rank	Yield (bu/A)	GA Griffin	KY ¹ Lexington	MD Queenstown	NC Kinston	NE Lincoln	OH Wooster	PA University Park	SC Clemson	SC Florence	TX Prosper	VA Blacksburg	VA Warsaw
VA97B-388	1	114.0	138.6	83.9	91.3	99.2	97.6	136.7	141.0	114.0	118.0	95.2	119.3	133.0
Price	9	102.3	109.1	79.7	81.5	80.9	87.4	123.2	124.0	113.0	94.9	98.0	113.7	122.2
Callao	12	100.1	106.2	64.6	78.9	80.2	78.9	89.9	138.7	112.0	105.0	111.9	111.7	123.5
Wysor	17	93.0	107.9	74.4	84.1	90.2	82.3	77.6	123.0	94.6	70.9	82.0	116.4	112.6
Nomini	5	104.1	120.8	95.0	85.7	99.2	105.1	100.2	123.0	110.0	90.4	76.5	123.0	120.3
Perkins	23	81.1	85.1	64.2	85.8	74.5	87.5	91.6	94.0	74.0	69.2	85.7	68.1	93.3
VA97B-178	6	103.8	113.1	89.3	75.3	91.2	88.1	91.9	134.0	108.0	104.0	104.9	117.1	129.3
VA97B-176	2	112.9	130.2	75.4	85.8	110.8	97.8	109.3	141.0	118.0	116.0	115.5	123.9	130.6
Average (N=25)		95.4	101.5	74.8	78.7	82.0	88.2	100.3	123.0	94.0	84.9	88.4	107.9	116.4
LSD (0.05)		8.9	24.2*	10.5*	21.2	15.2	18.8*	16.8*	17.0*	13.0	16.0	13.7	10.6*	10.3*
C.V. (%)		11.5	14.8	8.2	16.4	11.6	15.5	12.6	8.0	8.5	11.0	17.5	7.2	6.4

¹ Results of 2 reps.

* LSD (0.10)

Table 9. Performance of VA97B-388 versus check varieties in the 1999-2000 Uniform Winter Barley Nursery:
Averages over all stations for indicated characters.

Selection or Variety	Yield Rank	Yield (bu/A)	Test Weight (lbs/bu)	Heading Date (Julian)	Height (in.)	Lodging (0-9) ¹	Leaf Rust (0-9)	Powdery Mildew (0-9)
VA97B-388	1	114.0	47.0	108	34.9	1.3	4.0	0.5
Price	9	102.3	47.0	106	32.8	1.1	2.5	0.5
Callao	12	100.1	47.8	105	32.3	4.4	2.0	0.0
Wysor	17	93.0	46.4	108	35.8	2.5	3.5	0.0
Nomini	5	104.1	46.5	106	37.9	1.8	2.5	0.0
Perkins	23	81.1	48.5	114	36.5	3.8	4.5	1.5
VA97B-178	6	103.8	47.0	107	32.2	2.7	3.0	0.5
VA97B-176	2	112.9	47.0	104	32.6	2.1	2.5	0.5
<i>Average (N=25)</i>		95.4	47.5	109	35.5	2.9	3.7	1.3
<i>LSD (0.05)</i>		8.9	1.8	2.0	1.5	1.7	ns ²	1.7
<i>C.V. (%)</i>		11.5	4.6	2.2	4.7	51.0	19.8	62.2
<i>No. Locations</i>		12	12	11	10	6	2	2

¹ All 0-9 ratings indicate relative disease/lodging severity: 0 = no disease/lodging present; 9 = total infestation of the plant by disease/completely lodged.

² Not significant.

Table 10. Percent winter survival of VA97B-388 versus check varieties at the various stations in the 2000-2001 Uniform Barley Winter Hardiness Nursery.

Selection or Variety	Rank According to Mean	Means Across Locations	Nairn Canada	Hays KS	Manhattan KS	Lincoln NE	Mead NE	Waynesville NC	Watertown SD	Knoxville TN	Prosper TX
VA97B-388	18	54.5	88.0	2.5	95.0	0.0	0.0	100.0	5.0	100.0	100.0
Tenn. Winter	25	50.0	65.0	0.0	90.0	0.0	0.0	97.5	0.0	100.0	97.5
Trebi	27	35.0	10.0	0.0	60.0	0.0	0.0	85.0	0.0	62.5	97.5
Kearney	9	56.1	92.5	17.5	85.0	95.0	0.0	97.5	15.0	100.0	97.5
Kenosha	1	86.7	100.0	100.0	100.0	100.0	90.0	97.5	5.0	100.0	97.5
Dicktoo	8	58.2	86.0	37.5	100.0	75.0	0.0	100.0	0.0	100.0	100.0
Kentucky 1	7	58.6	84.5	50.0	95.0	15.0	0.0	100.0	0.0	100.0	97.5
VA97B-176	11	55.7	99.0	2.5	100.0	5.0	0.0	95.0	5.0	100.0	100.0
Average (N=27)		58.6	85.1	23.4	91.0	23.3	5.4	98.7	2.6	98.6	99.5
LSD (0.05)		14.2	24.4	20.9	19.5	13.2	14.5	5.3	ns ¹	7.0	ns ¹
C.V. (%)		12.4	14.0	43.4	10.4	27.5	131.7	2.6		3.5	

¹ Not significant.

Table 11. Percent winter survival of VA97B-388 versus check varieties at the various stations in the 1999-2000 Uniform Barley Winter Hardiness Nursery.

Selection or Variety	Rank According to Mean	Means Across Locations ¹	Canada Nairn	Turkey Eksehir	NE Lincoln	NE Mead	TX Dallas	Rank According to Mean	Means Across Locations ²	KS Manhattan ³
VA97B-388	1	93.5	97.5	70.0	100.0	100.0	100.0	12	85.5	5.0
Price	8	88.0	90.0	50.0	100.0	100.0	100.0	3	89.1	100.0
Tenn. Winter	22	81.0	77.5	37.5	95.0	95.0	100.0	23	73.6	0.0
Trebi	29	63.0	12.5	7.5	100.0	95.0	100.0	29	57.3	0.0
Kearney	19	83.0	80.0	35.0	100.0	100.0	100.0	13	84.5	100.0
Kenosha	9	87.8	99.0	55.0	100.0	85.0	100.0	4	88.9	100.0
Dicktoo	12	86.5	95.0	52.5	100.0	85.0	100.0	7	87.7	100.0
Kentucky 1	15	85.0	92.5	42.5	90.0	100.0	100.0	11	86.4	100.0
VA97B-178	6	90.0	80.0	70.0	100.0	100.0	100.0	2	90.9	100.0
VA97B-176	5	90.3	89.0	62.5	100.0	100.0	100.0	10	86.6	50.0
<i>Average (N=29)</i>		83.6	76.3	46.3	99.1	96.9	99.1		80.0	43.5
<i>LSD (0.05)</i>		18.6	14.3	23.2	ns ⁴	6.6	0.9			
<i>C.V. (%)</i>		11.7	14.5	38.3		5.3	0.7			

¹ Means obtained by MSTAT analysis excluding data from Manhattan location.

² Unweighted means calculated for the locations including Manhattan.

³ Data from single replication of one meter row plots.

⁴ Not significant.

Table 12. Grain yields (bu/ac) of VA97B-388 in 2000-2001 Official Variety Trials.

Line	VA	MD	TN	NC	AL	AL	SC	SC	SC	SC	GA	PA	PA
	N=5 ¹	N=5	N=3	Rowan Co.	Belle Mina	Crossville	Clemson (Early-sown)	Clemson (Late-sown)	Florence	Blackville	Plains	Centre Co.	Lancaster Co.
VA97B-388	120	117.7	65	61	59.8	86.0	108.5	69.2	123.3	95.9	110.7	123	107
Price	110	114.1	80	67	62.6	97.9					111.7	121	100
Callao	104	104.7	83		55.4	83.5	103.2	74.5	127.9	98.3		125	99
Nomini	106	110.6	85		55.8	89.0	121.6	53.3	125.9	96.3	107.5	100.0	103
Wysor	98										83.7		
Boone				63			99.7	75.1	120.1	96.2	82.7		
Mean	101	109.2	76.4	67			98.2	61.9	115.4	93.6	101.9	109	104
LSD (0.10)	7 ²	13.2 ²		10 ³			8.8	9.6	11.5	9.7	13.4	16 ²	14 ²
C.V. (%)	10	16.8	11.6	13.2			7.5	13.0	8.4	8.6	11.2	10	10

¹ N=number of locations upon which data are based.² LSD (0.05)³ BLSD (K-50)

Table 13. Grain yields (bu/ac) of VA97B-388 in 2001-2002 Official Variety Trials.

Line	VA	MD	NC	NC	AL	AL	SC	SC	SC	SC	SC	SC	SC	GA	GA
	N=5 ¹	N=5	Lenoir Co.	Rowan Co.	Belle Mina	Crossville	SC (Early- sown)	SC (Late- sown)	Florence	Blackville	Plains	Calhoun			
VA97B-388	119	106.1	41	124	79	77	51.1	77.9	43.0	44.9	81.4	29.1			
Price	109	93.1	68	119	62	73	65.8	79.3	57.1	59.1	92.2	33			
Callao	101	83.7			65	86	56.9	81.8	55.4	52.7					
Nomini	113	86.1			64	82	55.0	75.0	40.0	60.1	75.6	28.4			
Wysor	101										65.8	19.9			
Boone			38	105			51.3	68.4	56.0	42.7	57.4	23.8			
Mean	107	90.3	54	117	66	81	50.8	69.0	43.0	45.9	71.5	28			
LSD (0.10)	5 ²	8 ²	6 ³	8 ³	6	9	5.3	7.9	5.3	5.2	11.9	7.8			
C.V. (%)	8	12.3	11.4	13.8	6	8	9.0	9.5	10.6	9.5	13.8	23.1			

¹ N=number of locations upon which data are based.² LSD (0.05)³ BLSD (K-50)

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). The information is held confidential until the certificate is issued (7 U.S.C. 2426).

EXHIBIT E
STATEMENT OF THE BASIS OF OWNERSHIP

1. NAME OF APPLICANT(S) Virginia Tech Intellectual Properties, Inc.	2. TEMPORARY DESIGNATION OR EXPERIMENTAL NUMBER VA97B-388	3. VARIETY NAME Thoroughbred
4. ADDRESS (Street and No., or R.F.D. No., City, State, and ZIP, and Country) 1872 Pratt Drive Suite 1625 Blacksburg, VA 24060	5. TELEPHONE (Include area code) 540-951-9374	6. FAX (Include area code) 540-951-5292
7. PVPO NUMBER 200500265		

8. Does the applicant own all rights to the variety? Mark an "X" in the appropriate block. If no, please explain. ☐ YES ☒ NO9. Is the applicant (individual or company) a U.S. national or a U.S. based company? If no, give name of country. ☐ YES ☒ NO10. Is the applicant the original owner? ☐ YES ☒ NO If no, please answer one of the following:

a. If the original rights to variety were owned by individual(s), is (are) the original owner(s) a U.S. National(s)?

☐ YES ☒ NO If no, give name of country

b. If the original rights to variety were owned by a company(ies), is (are) the original owner(s) a U.S. based company?

☒ YES ☐ NO If no, give name of country

11. Additional explanation on ownership (If needed, use the reverse for extra space):

Original owner Virginia Polytechnic Institute and State University assigned its ownership to current owner Virginia Tech Intellectual Properties, Inc. (See Attached document).

PLEASE NOTE:

Plant variety protection can only be afforded to the owners (not licensees) who meet the following criteria:

1. If the rights to the variety are owned by the original breeder, that person must be a U.S. national, national of a UPOV member country, or national of a country which affords similar protection to nationals of the U.S. for the same genus and species.
2. If the rights to the variety are owned by the company which employed the original breeder(s), the company must be U.S. based, owned by nationals of a UPOV member country, or owned by nationals of a country which affords similar protection to nationals of the U.S. for the same genus and species.
3. If the applicant is an owner who is not the original owner, both the original owner and the applicant must meet one of the above criteria.

The original breeder/owner may be the individual or company who directed the final breeding. See Section 41(a)(2) of the Plant Variety Protection Act for definitions.

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0581-0055. The time required to complete this information collection is estimated to average 0.1 hour per response, including the time for reviewing the instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, gender, religion, age, disability, sexual orientation, marital or family status, political beliefs, parental status, or protected genetic information. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, Room 326-W, Whitten Building, 14th and Independence Avenue, SW, Washington, D.C. 20250-9410 or call (202) 720-5964 (voice and TDD). USDA is an equal opportunity provider and employer.

GROUP GERMPLASM ASSIGNMENT

VTIP 03.017	VA97W-24
VTIP 03.018	VA98W-586
VTIP 03.019	VA98W-706
VTIP 03.020	VA98W-750
VTIP 03.021	VA98W-817
VTIP 03.022	DAN/VA97B-388 Barley
VTIP 03.023	DOYCE/VA00H-137 Barley
VTIP 03.024	VT67 and VT120 Soybean

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY (hereinafter referred to as the "UNIVERSITY"), assigns to VIRGINIA TECH INTELLECTUAL PROPERTIES, INC. (hereinafter referred to as "VTIP") all rights, title and interest in and to all of the above-listed GERMPLASMS as held by the UNIVERSITY.

The UNIVERSITY, by its authorized agents, agrees that it will execute all necessary assignments as requested by VTIP, to facilitate the filing of patent applications and/or copyright registrations. It will render any reasonable assistance requested to aid in preparation of such applications and/or registrations.

The UNIVERSITY shall retain the right to make use of the GERMPLASMS for internal research and other non-commercial purposes without cost to the UNIVERSITY.

All royalties, rents, payments, or any cash receipts from the sale, assignment, transfer, licensing or use of the GERMPLASMS shall be the property of VTIP and shall be distributed according to the provisions of the Virginia Agricultural Experiment Station (VAES) Plant Germplasm Release Policy (PGRP).

Prior to the execution of this Assignment, the UNIVERSITY has not granted the right of license to make, use, or sell said GERMPLASMS to anyone except to VTIP, nor has it otherwise encumbered its rights, title and interest in said GERMPLASMS, and it will not execute any instrument in conflict with this Assignment.

IN WITNESS WHEREOF, the UNIVERSITY has caused this Assignment to be signed this 25 day of March, 2003.

VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

BY 

MINNIS E. RIDENOUR
Chief Operating Officer

STATE OF VIRGINIA

COUNTY OF MONTGOMERY, to-wit:

The foregoing instrument was acknowledged before me this 25th day of
March, 2003, by Marius E. Ridenour
of Virginia Polytechnic Institute and State University, on behalf of said University.

Gerry M. Chenaux
Notary Public

My commission expires: 2/28/07